


Environmental Product Declaration

For Fire Resistant Glass (FRG)
from
AIS Glass Solutions Ltd.

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021

PROGRAMME	The International EPD® System
PROGRAMME OPERATOR	EPD International AB
GEOGRAPHICAL SCOPE	Global
EPD REGISTRATION NUMBER	EPD-IES-0024571
PUBLICATION DATE	2025-06-18
REVISION DATE	2025-09-03
VALID UNTIL	2030-06-17

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Programme Information

The International Organization for Standardization (ISO) 14025 defines an Environmental Product Declaration (EPD) as a Type III declaration that quantifies environmental information about a product's life cycle. Based on ISO series 14040, the Life Cycle Assessment (LCA) forms the basis of the EPD approach. EPDs are primarily meant to assist business-to-business interactions, but they may also be useful to environmentally conscious consumers when purchasing goods or services.

Programme	The International EPD® System
Declaration Holder	AIS Glass Solutions Ltd.
Declaration Number	EPD-IES-0024571
Declaration Products	Fire Resistant Glass (FRG)
Address	EPD International AB, Box 21060, SE-10031 Stockholm, Sweden
Website	www.envirodec.com ; www.environdecindia.com
Email	info@environdec.com
Product Category Rules (PCR):	PCR 2019 :14 Construction products (EN 15804 :2012: A2) version 1.3.4 and its c-PCR-009 Flat glass products used in buildings and other construction works (EN17074:2019)
Verification and reference PCR:	CEN standard EN 15804 serves as the core Product Category Rules (PCR)
The PCR review was conducted by:	The Technical Committee of the International EPD System. See www.envirodec.com for list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariate www.environdec.com/contact.
Independent third-party verification of the declaration and data, according to ISO 14025:2006: ✔ EPD process verification ✔ EPD verification	
This declaration was independently verified in accordance with ISO 14025:2006 by:	Sunil Kumar SIPL Pvt Ltd sunil@sipl-sustainability.com
This life cycle assessment and EPD design was conducted by:	Suraj Shekhar, Sustainability Consultant, The ESG Advisory suraj.shekhar@theesgadvisory.in
Address and Contact of the EPD Owner:	AIS Glass Solutions Ltd., Village Latherdeva Hoon Mangalore, Jhabrera Road, PO Jhabrera, Tehsil Roorkee, Dist. Haridwar, 247665 Contact person: Mr. Tushar Zope Email: tushar.zope@aisglass.com

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

EPDs within the same product category but registered in different EPD programs, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterization factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at: www.environdec.com

Company Information

AIS Glass Solutions Ltd. is India's leading integrated glass and window solutions company and a dominant player both in the automotive and the building & construction segments. Our product solutions, spanning the entire breadth of automotive, building & construction, and consumer glass, are designed to deliver aesthetics and functional benefits. Starting operations in 1987, AIS is an outcome of a Joint Venture between the Labroo family, Asahi Glass Co. Limited Japan (now AGC Inc.), and Maruti Udyog Limited (now Maruti Suzuki India Limited., MSIL)

AIS' presence extends all across India with around **15 plants** and 10 sub-assemblies cum warehouses and 6 offices. Our worldwide presence is across nations like Sri Lanka, Africa and many parts Middle East Asia. To focus better on specific market segments and to serve customers better, AIS has organized its business into 3 Strategic Business Units (SBUs):

- **Automotive**
- **Building & Construction**
- **Consumer Glass**

It is engaged in production and delivery of next generation glass products and solutions to retail and institutional customers though these SBUs and provides end-to-end solutions across the entire value chain - from manufacturing of float glass to glass processing, fabrication and installation.

AIS has been honored with awards and recognition as acknowledgement of its contributions to the glass industry. Corporate governance is an intrinsic part of the Company. AIS is committed to achieving the highest standards of accountability, transparency, and equity in all its spheres and dealings with its stakeholders. AIS is an **ISO 9001** and **ISO 14001** company listed on the National Stock Exchange Limited and Bombay Stock Exchange Limited.

With the development of innovative construction techniques and glass-processing methods, AIS products are manufactured to deliver superior performance and added value. Our manufacturing units are equipped with state-of-the-art machinery that delivers a full range of high-quality processed and value-added glass products meeting international standards.

At AIS, we do not compromise on the quality of the product that we deliver. Our products are put through stringent inspections in our well-equipped laboratory and testing facilities to ensure the highest quality. After inspection, they are stored in a clean environment. All our products adhere to ISO 9001:2015, IS 2553 Part-1 for tempered & laminated glasses & IS 2553 Part 2 for Tempering. In AIS Glass Solutions Ltd, we manufacture a wide range of value-added solutions. Some of our leading brands are:

- **AIS Stronglas™:** - High-grade tempered glass
- **AIS Securityglas™: -** Specially toughened, laminated safety glass
- **AIS SecurityPlus™: -** Reinforced by a special layer of PVB, AIS SecurityPlus is up to five times stronger than conventional laminating materials.
- **AIS Acousticglas™**: - Acoustic lamaiaisinated glass
- AIS Insulated Glass Unit (IGU)
- AIS Swytchglas™: - Smart Privacy and UV protection at a switch of a button
- **AIS Fire-Resistant Glass**: **- AIS Pyrobel** offers high- quality fire- resistant glass solutions that help prepare for unexpected fire breakouts and minimize the risk of fatalities, offering safe, secure, comfortable living & working spaces along with enhanced aesthetics.

  Range of AIS FRG products: - **PYROBEL(ITE)**, **VISION LINE**, **PYROBEL-T** (two-sided Fire-Resistant Glass)

State-Of-The-Art Facilities: -

With the development of innovative construction techniques and glass-processing methods, AIS products are manufactured to deliver superior performance and added value. Our manufacturing units are equipped with state-of-the-art machinery that delivers a full range of high-quality processed and value-added glass products meeting international standards.

Our manufacturing plants for AIS Glass Solutions are located at:

- Roorkee, Uttarakhand (North)
- Bengaluru, Karnataka (South)

Quality Standards: -

At AIS Glass Solutions, we do not compromise on the quality of the product that we deliver. Our products are put through stringent inspections in our well-equipped laboratory and testing facilities to ensure the highest quality. After inspection, they are stored in a clean environment.

All our products adhere to the following international standards:

- **ISO 9001:2015 Certified**
- **IS 2553 Part-1 for tempered & laminated glasses**
- **IS 2553 Part 2 (Tempering)**

At AIS Glass Solutions Ltd., with our unmatched glass processing capabilities, we are committed to providing the finest quality, best in class value-added glass products and solutions, ensuring we meet every need of our customers.

Figure: AIS FRG Manufacturing Facility

EPD Owner:

AIS Glass Solutions Ltd., Village Latherdeva Hoon Mangalore, Jhabrera road, PO Jhabrera, Tehsil Roorkee, Dist. Haridwar, 247665

Contact Person: Mr. Tushar Zope

Email: tushar.zope@aisglass.com

Product Information:

Pyrobel-T is a fire-resistant laminated glass in conformance with EN 14449 and fire properties according to EN 1346 / EN 1634 / IS 16945 / IS 16947.
The products are composed of several layers of glass and transparent intumescent interlayers. Every single tempered glass pane constituting the Pyrobel-T undergoes a Heat Soak Test. In the event of a fire, the interlayer(s) transform into rigid and opaque fire shield(s) that keep out flames and limit heat transmission through glazing. The product ensures integrity and prevents thermal radiation transfer or ignition of flammable substances on the unexposed side of the fire-resistant glass.
The glass delivers fire protection in both directions.
Final product (Pyrobel-T) is **RoHS Compliant.**

For a detailed product description refer to the manufacturer specifications or the product specifications of the respective offer/quotation.

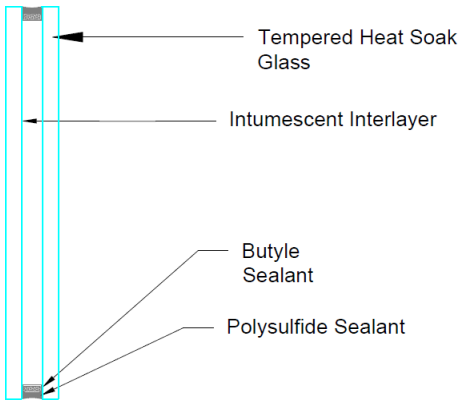

Figure: Typical construction for illustration purpose

UN CPC Code- IGUs are classified CPC3711 under the UN CPC classification system v2.1.

Intended Use
Fire Resistant Glass can be used either as component of an external glazing or as internal partition. It is widely used in doors, windows, and partitions for fire-rated zones in residential, commercial, and industrial buildings.

Figure: One of the Typical applications of Fire-Resistant Glass

Performance Data

Fire Resistant Glass is available in two variants: 12mm and 16mm- Pyrobel-T (4/4/4) and Pyrobel-T (6/4/6)
Fire Performance data is as per EN 1346 / EN 1634 / IS 16945 / IS 16947.

Table: Data below depicts the performance characteristics of the Fire-Resistant Glass

Parameters	**Pyrobel-T 12 (4/4/4)**	**Pyrobel-T 16 (6/4/6)**
Application	Interior / Exterior	Interior / Exterior
Nominal Thickness	12mm	16mm
Thickness Tolerance	±1mm	±1mm
Weight	27 Kg/Sq.m	36 Kg/Sq.m
Dimensional Tolerance	±2mm	±2mm
Light Transmission (EN410)	87%	87%
Ug Value (EN 673)	5.49 W/Sq.m K	5.37 W/Sq.m K
Safety Rating (EN 12600)	Class A 1B1	Class A 1B1
Sound Reduction RX Index (En12758)	38 dB	39dB
Cuttable	No	No

Content Declaration

Table: Content Declaration of Fire-Resistant Glass

Product Components	**Pyrobel-T 12 (4/4/4)**	
	Weight, Kg	**Weight, %**
Glass	20.71	77%
Fire Resistant Interlayer	5.90	22%
Butyl Sealant	0.13	0%
Polysulfide Sealant	0.26	1%
Total	27	100%

Table: Packaging details of Fire-Resistant Glass

Product Components	**Weight, %**
Wood	93%
Steal Strap	2%
Bubble Polythene	1%
EVA Foam	3%
Others	1%
Total	100%

Life Cycle Assessment

Geographical scope:	Global
Declared unit:	One square meter (1 m^2)
Declared Product:	Fire Resistant Glass
UN CPC Code	3711
Reference service life:	A reference service life of 30 years is used for this EPD, as prescribed in EN 17074:2019.
Time representativeness:	Primary data from the manufacturing site, suppliers, and the electricity mix were collected for the period starting from 1st April 2023 and 31st March 2024
Database(s) and LCA software used:	Ecoinvent v3.10 (allocation, cut-off by classification) database and SimaPro v9.6 software have been used for the LCA calculations. LCA methods used are EN 15804: A2; EF3.1 compliant.
Description of system boundaries	Cradle to grave with Module D (A+B+C+D)
A+b+c+d)	According to EN 15804:2012+A2:2019/AC:2021 specific data was used for module A3 (Processes the manufacturer has influence over) and was gathered from the AIS Glass Solutions Ltd. Manufacturing unit. Specific data includes actual product weights, amounts of raw materials used, product content, energy consumption, transport figures, water consumption, and amounts of waste.
Allocation:	In this study, allocation has not been applied.
Cut-off rules:	Life Cycle Inventory data for a minimum of 99 % of total inflows to the life cycle stages have been included and a cut-off rule of 1% regarding energy, mass and environmental relevance was applied. Impacts caused by treatment operations have been calculated lower than 1% environmental relevance.

According to EN 15804+A2, EPD of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPD might not be comparable if they are from different programs

Modules Declared, Geographical Scope, Share of Specific Data and Data Variation

Table: Declared Modules, Geographical Scope, Share of Specific Data and Data Variation

X: Declared ND: Not declared	Product stage		Construction process stage			Use stage							End-of-life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Recycling potential
Module	**A1**	**A2**	**A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	GLO	GLO	IN	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO	GLO
Specific data used	>80			-	-	-	-	-	-	-	-	-	-				-
Variation – products	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

Declaration of Sources and Share of Primary Data

Table: Declaration of Sources and Share of Primary Data

Process	Source type	Source	Reference Year	Data category	%Share of primary data of GWP-GHG results for A1-A3
Base Glass	EPD	EPD-IES-0024574	2024	Primary Data	46.5
Others (Interlayer+ Sealants)	Database	Ecoinvent 3.10	2024	Secondary Data	14.2
Electricity	Database	Ecoinvent 3.10	2024	Primary Data	25.1
Transportation	Database	Ecoinvent 3.10	2024	Primary Data	9.8

Manufacturing Flow Chart

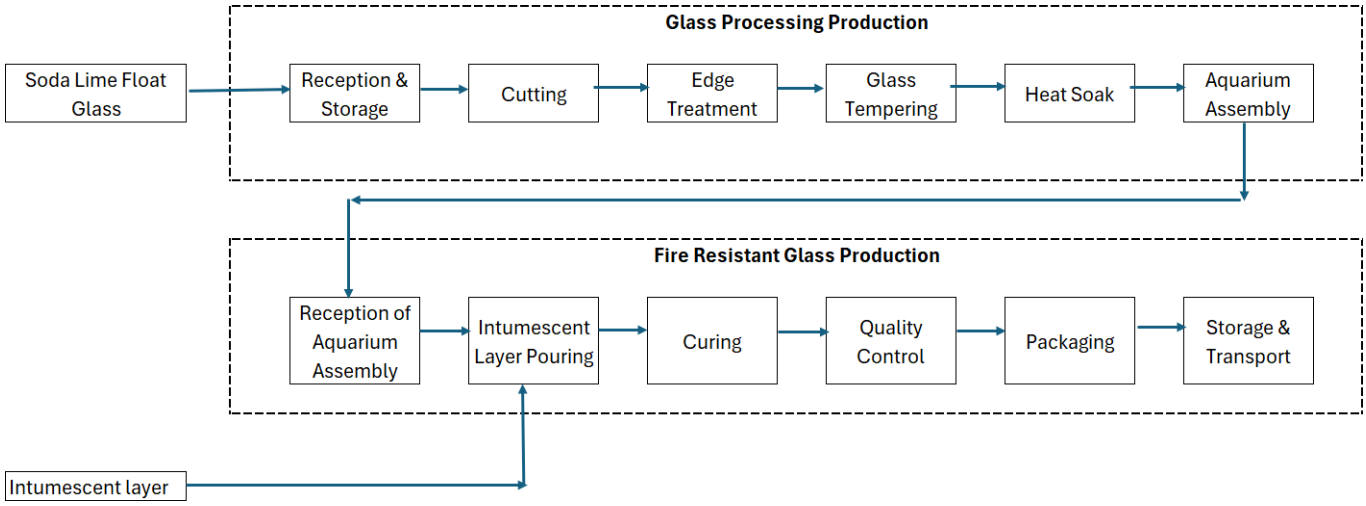

Figure: Manufacturing Process of Fire-Resistant Glass

Glass Processing Production

- **Reception & Storage** – Soda-Lime float glass is received from the float plant & is stored in the Glass Processing Unit.
- **Cutting** – As per the requirement of sheet thickness, glass is taken from storage by auto-glass cutting loader & cut as per customer order requirement.
- **Edge Treatment** – Edge treatment is done as per the quality process.
- **Tempering** – Tempering of glass done as per quality process.
- **Heat Soak** – Heat Soak of glass done to avoid any Nickel Sulfide impurities.
- **Aquarium Assembly** – Layers of glass are assembled to create a chambers & is seal by primary & secondary sealant.

Fire Resistant Glass Production

- **Reception of Aquarium Assembly** - As per production requirement, receipt of aquarium assembly at FRG manufacturing unit.
- **Intumescent Layer Pouring** - Mixed intumescent interlayer poured into chambers & hole is sealed by hot melt sealant.
- **Curing** - Product is cured to achieve transparency of glass.
- **Quality Control** - Glass is inspected as per quality process document before labelling & packing.
- **Packaging** - Glasses are packed as per customer order & as per size of glasses.
- **Storage & Transport** - Packed glasses are stored at the dispatch section till arrival of transport vehicle & commercial clearance and then dispatch to destinations.

Life Cycle stages

A1-A3, Cradle to Gate – *Mandatory Module*
The product stage includes the extraction and processing of raw materials and energies, transport to the manufacturer, manufacturing and processing of glass.

A1, Raw materials supply:
This includes the extraction and processing of all raw materials and energy which occur upstream from the manufacturing process.

A2, Transport to the manufacturer:
The raw materials are transported to the manufacturing site. The modelling includes road, ship and/or train transportation of each raw material.

A3, Manufacturing:
This module includes the manufacture of products and the manufacture of packaging. The production of packaging material is considered at this stage. The processing of any waste arising from this stage is also included.

A4-A5, Construction process stage
The construction process is divided into 2 modules: A4, transport to the building site and A5, installation in the building.

A4, Transport to the building site:
This module includes transport from the production gate to the building site.

Parameter	Value
Vehicle	Vehicle type Truck-trailer: Lorry_11 metric ton
Distance to construction Site	1000 km
Bulk density of transported products*	2500 kg/m3

A5, Installation in the building:
The accompanying table quantifies the parameters for installing the product at the building site. All installation materials and their waste processing is included.

Parameter	Value
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	According to PCR EN 17074, no waste is considered
Output materials (specified by type) as results of waste processing at the building site e.g. of collection for recycling, for energy recovery, disposal (specified by route)	30% Packaging Wood recycled 70% (Packaging Wood Incinerated without energy recovery)

B1 -B7 De-construction

The use stage is divided into the following modules:

- **B1: Use**
- **B2: Maintenance**
- **B3: Repair**
- **B4: Replacement**
- **B5: Refurbishment**
- **B6: Operational energy use**
- **B7: Operational water use**

The product has a reference service life of 30 years. This assumes that the product will last in situ with no requirements for repair, replacement or refurbishment throughout this period. Therefore, it has no impact at this stage, except for maintenance.

B2, Maintenance:

According to PCR EN 17074, only the maintenance by cleaning glass with water and cleaning agent is included in this study.

Parameter	Value
Maintenance process	Water and cleaning agent
Maintenance cycle	Annual average
Ancillary materials for maintenance (e.g. cleaning agent, specify materials)	cleaning agent: 0.001 kg/m² of glass/year
Wastage material during maintenance (specify materials)	0 kg
Net freshwater consumption during maintenance	0.2 kg/m² of glass/year
Energy input during maintenance	None required during product lifetime

C1-C4, End of Life Stage

C1 - De-construction

The de-construction and/or dismantling of the product take part of the demolition of the entire building. Energy consumption for
demolition is considered 0.01 kWh/m².

C2 - Transport to waste processing

It is estimated that there is no mass loss during the use of the product therefore the end-of-life product is assumed to have the same weight as the declared product whole. End of life products are assumed to be sent to the closest facilities such as landfills. Transportation distance to the closest disposal area is estimated 50 km.

C3 - Waste processing for reuse, recovery and/or recycling

It is assumed that 100% of products are collected at demolition sites and sent directly to landfill facilities.

C4 - Final Disposal

100% of the glass is landfilled. The landfill site is at the distance of 50km.
Biogenic balancing for packaging has been done in A5.

Table: Parameters C1-14 module

Parameter	Value
Thickness (mm)	12 mm
Collection process specified by type	27 kg collected per 1 m2 0 kg collected with no separation between construction product
Recovery system specified by type	0 kg reuse 0 kg recycled 0 kg for energy recovery
Disposal specified by type	27 kg disposed of in landfill per 1 m2
Assumptions for scenario development (e.g. transportation)	50 km to landfill site and 0 km for recycling site
Transport by Truck	Lorry_11 metric ton
Database	India specific Transportation Process & Ecoinvent 3.10

D - Reuse, recovery or recycling

No benefits are accounted for in the assessment.

Electricity Modelling

84% of electricity is taken from Electricity Grid of India and 16% from the solar. Climate impact as kg CO2 eq./kWh using the GWP-GHG indicator for Gird electricity is **0.963 kg CO2 eq./kWh** and for Solar panel is **0.064 kg CO2 eq./kWh.**

Environmental Performance

Results for 1m2 of Fire-Resistant Glass – Pyrobel-T (4/4/4)

Table: Potential environmental impact – mandatory indicators according to EN 15804:2012+A2:2019/AC:2021

Results for 1m² of Pyrobel-T (4/4/4)																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP- total	kg CO2 eq	5.18E+01	2.13E-01	5.74E+00	0.00	1.80E-01	0.00	0.00	0.00	0.00	0.00	1.30E-01	1.06E-01	0.00	7.39E-02	0.00
GWP-biogenic	kg CO2 eq	-5.88E+00	0.00	5.88E+00	0.00	3.01E-02	0.00	0.00	0.00	0.00	0.00	7.68E-05	3.15E-05	0.00	1.07E-04	0.00
GWP-fossil	kg CO2 eq	5.77E+01	2.13E-01	-1.45E-01	0.00	7.84E-02	0.00	0.00	0.00	0.00	0.00	1.30E-01	1.06E-01	0.00	7.38E-02	0.00
GWP- luluc	kg CO2 eq	2.62E-02	2.89E-06	-2.07E-04	0.00	7.18E-02	0.00	0.00	0.00	0.00	0.00	2.44E-06	1.44E-06	0.00	1.86E-05	0.00
ODP	kg CFC11 eq	1.63E-06	3.65E-08	-1.90E-10	0.00	4.39E-09	0.00	0.00	0.00	0.00	0.00	7.00E-10	1.83E-08	0.00	4.17E-09	0.00
AP	mol H+ eq	4.11E-01	1.83E-03	-3.16E-04	0.00	4.98E-04	0.00	0.00	0.00	0.00	0.00	8.35E-04	9.15E-04	0.00	3.33E-04	0.00
EP-freshwater	kg P eq	5.64E-03	1.21E-06	-1.14E-05	0.00	3.23E-05	0.00	0.00	0.00	0.00	0.00	7.97E-07	6.07E-07	0.00	5.32E-06	0.00
EP-marine	kg N eq	1.01E-01	9.12E-04	-1.70E-04	0.00	5.33E-04	0.00	0.00	0.00	0.00	0.00	1.06E-04	4.56E-04	0.00	1.18E-04	0.00
EP-terrestrial	mol N eq	9.78E-01	9.98E-03	-1.42E-03	0.00	1.38E-03	0.00	0.00	0.00	0.00	0.00	1.16E-03	4.99E-03	0.00	1.29E-03	0.00
POCP	kg NMVOC eq	2.58E-01	2.38E-03	-1.96E-04	0.00	3.21E-04	0.00	0.00	0.00	0.00	0.00	3.34E-04	1.19E-03	0.00	7.31E-04	0.00
ADPE	kg Sb eq	1.59E-04	6.25E-09	-2.29E-07	0.00	2.55E-06	0.00	0.00	0.00	0.00	0.00	6.61E-08	3.12E-09	0.00	1.55E-07	0.00
ADPF	MJ	5.34E+02	1.80E+00	-3.93E-02	0.00	1.38E+00	0.00	0.00	0.00	0.00	0.00	1.72E+00	8.99E-01	0.00	1.11E-01	0.00
WDP	m3 W eq. Dep	5.67E+03	3.32E-03	-6.13E-03	0.00	3.27E-01	0.00	0.00	0.00	0.00	0.00	4.50E+01	1.66E-03	0.00	1.15E-02	0.00
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine= Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals & metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption															

Table: Potential Environmental impact-*additional mandatory*

Results for 1m² of Pyrobel-T (4/4/4)																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP - GHG	kg CO2 eq.	5.02E+01	2.12E-01	1.30E+00	0.00	7.84E-02	0.00	0.00	0.00	0.00	0.00	1.30E-01	1.06E-01	0.00	7.30E-02	0.00
Acronyms	GWP-GHG = Global Warming Potential															

*The use of results of modules A1-A3 (A1-A5 for services) without considering the results of module C is discouraged.
*The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks

Table: Potential environmental impact – *additional voluntary indicators*

Results for 1m² of Pyrobel-T (4/4/4)																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
PM/RI	[disease inc.]	2.50E-06	4.13E-09	-2.37E-09	0.00	5.95E-09	0.00	0.00	0.00	0.00	0.00	4.40E-09	2.07E-09	0.00	5.83E-09	0.00
IRP	[kBq U235 eq]	1.42E+00	1.26E-02	-3.24E-04	0.00	5.53E-03	0.00	0.00	0.00	0.00	0.00	2.83E-04	6.31E-03	0.00	3.12E-03	0.00
ET-freshwater	[CTUe]	1.82E+03	7.30E-01	-2.74E+00	0.00	1.68E+00	0.00	0.00	0.00	0.00	0.00	4.72E-01	3.65E-01	0.00	2.83E-01	0.00
HT-cancer	[CTUh]	2.77E-07	2.19E-12	-6.23E-11	0.00	1.83E-10	0.00	0.00	0.00	0.00	0.00	1.99E-09	1.09E-12	0.00	1.12E-11	0.00
HT-non-cancer	[CTUh]	2.63E-05	1.14E-	-3.80E-09	0.00	1.47E-09	0.00	0.00	0.00	0.00	0.00	2.06E-07	5.71E-11	0.00	4.07E-10	0.00
SQP	[pt]	3.54E+02	2.29E-02	-1.66E+01	0.00	4.01E+00	0.00	0.00	0.00	0.00	0.00	2.73E-02	1.14E-02	0.00	6.78E+00	0.00
Acronyms	PM = Particulate matter emissions; IRP = Ionizing radiation, human health; ET-freshwater = Eco-toxicity (freshwater); HT-cancer = Human toxicity, cancer effects; HT-non-cancer = Human toxicity, non-cancer effects; SQP = Potential soil quality index (SQP)															

Table: Use of resources

Results for 1m² of Pyrobel-T (4/4/4)																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
PERE	MJ	1.33E+02	5.80E-03	-2.18E+01	0.00	7.69E-01	0.00	0.00	0.00	0.00	0.00	2.67E-03	2.90E-03	0.00	5.01E-02	0.00
PERM	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PERT	MJ	1.33E+02	5.80E-03	-2.18E+01	0.00	7.69E-01	0.00	0.00	0.00	0.00	0.00	2.67E-03	2.90E-03	0.00	5.01E-02	0.00
PENRM	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PENRE	MJ	5.80E+02	1.90E+00	-4.12E-02	0.00	1.38E+00	0.00	0.00	0.00	0.00	0.00	1.81E+00	9.52E-01	0.00	1.14E-01	0.00
PENRT	MJ	5.80E+02	1.90E+00	-4.12E-02	0.00	1.38E+00	0.00	0.00	0.00	0.00	0.00	1.81E+00	9.52E-01	0.00	1.14E-01	0.00
SM	Kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
RSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NRSF	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FW	m3	1.93E+02	1.13E-04	-1.47E-04	0.00	7.61E-03	0.00	0.00	0.00	0.00	0.00	1.53E+00	5.66E-05	0.00	4.41E-03	0.00
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water															

*The use of results of modules A1-A3 (A1-A5 for services) without considering the results of module C is discouraged.
*The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks

Table: Waste production

Results for 1m² of Pyrobel-T (4/4/4)																
Indicator	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
HWD	Kg	1.65E-01	0.00	-1.23E-06	0.00	7.69E-11	0.00	0.00	0.00	0.00	0.00	7.53E-05	2.04E-03	0.00	1.71E-05	0.00
NHWD	Kg	2.75E+00	0.00	-1.43E-02	0.00	6.47E-03	0.00	0.00	0.00	0.00	0.00	7.15E-04	8.08E-05	0.00	2.70E+01	0.00
RWD	Kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acronyms	HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed;															

Table: Output flows

Results for 1m² of Pyrobel-T (4/4/4)																
Indicator	**Unit**	**1-A3**	**A4**	**A5**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	Kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MFR	Kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MER	Kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EEE	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
EET	MJ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Acronyms	MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electrical energy; EET = Exported thermal energy															

*The use of results of modules A1-A3 (A1-A5 for services) without considering the results of module C is discouraged.
*The estimated impact results are only relative statements, which do not indicate the endpoints of the impact categories, exceeding threshold values, safety margins and/or risks

Life Cycle Interpretation:

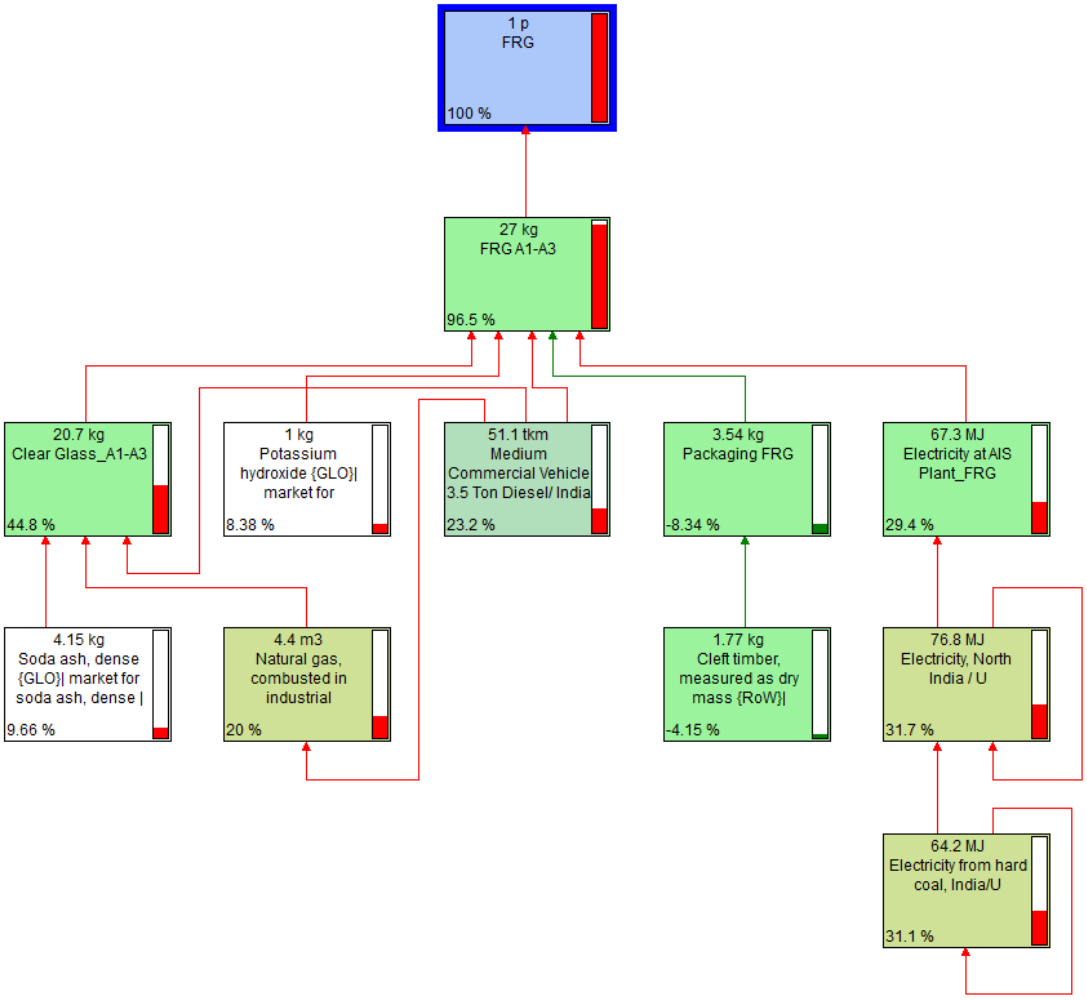

Figure: - Network diagram for GWP-GHG results as kg CO2 eq. for 1m² of Fire Resistance Glass (FRG) 12mm

Environmental Impact of 1m2 of Fire Resistance Glass was calculated as per EN 15804+A2. The system boundary for Life cycle assessment was considered from Cradle to Grave as per product category rules (PCR) for construction products. Clear glass GWP-GHG percentages shown above include contributions from electricity and transportation. That is the reason total is coming out to be more than 100%.

Module A1-A3, which covers raw material extraction, transport, and manufacturing, appeared as the highest impact contributor. Approximately 97% of the total environmental impact comes from the A1-A3 module.

References

- ISO 14040: 2006 Environmental Management -- Life cycle assessment -- Principles and framework
- ISO 14044: 2006 Environmental management -- Life cycle assessment -- Requirements and guidelines
- ISO 14025: 2006 Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures
- EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations - Core rules for the product category of construction products
- The International EPD® System / www.environdec.com
- The International EPD® System / The General Programme Instructions v5.0
- The International EPD® System / PCR 2019:14 Construction products v1.3.4 (EN 15804:A2) /
- https://api.environdec.com/api/v1/EPDLibrary/Files/04600e1f-ab96-4e05-9040- 08dabb52e166/Data
- Product Environmental Footprint Category Rules Guidance / https://ec.europa.eu/environment/eussd/smgp/pdf/PEFCR_guidance_v6.3.pdf
- Ecoinvent 3.10 / http://www.ecoinvent.org/
- SimaPro LCA Software / https://simapro.com/
- AIS Glass Solutions Ltd: https://www.aisglass.com/

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